

REMARKS

This paper is filed in response to the Office Action mailed on December 20, 2006. Presently, Claims 14-38, 42-57, 66-71, and 84-89 are pending in the application. Claims 14-22, 24-29, 31-36, 42-47, 49-54, 66-70, and 84-89 have been examined and stand rejected. Claim 88 is allowed. Claims 23, 30, 37, 48, 55-57, and 71 are objected to. Reconsideration and allowance of the rejected claims is respectfully requested.

The Rejection of Claim 89 Under 35 U.S.C. § 112, Second Paragraph

Claim 89 is rejected under 35 U.S.C. § 112, second paragraph as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 89 purportedly lacks antecedent basis.

Claim 89 has an obvious typographical error. Claim 89 has been amended to depend from Claim 88.

Accordingly, the withdrawal of the rejection is respectfully requested.

The Rejection of Claims 14-22, 24-29, 31-36, 42-47, 49-54, 66-70, and 84-88 Under 35 U.S.C. § 102(b)

Claims 14-22, 24-29, 31-36, 42-47, 49-54, 66-70, and 84-88 are rejected under 35 U.S.C. § 102(b) as being anticipated by WO97/40924 (Bahar et al.).

For a reference to be anticipatory, the reference must exactly describe the claimed invention.

Claims 14, 24, 31, 42, and 84 each recites having a graft polymer and also recites that the graft polymer is bound to a surface of a pore. At the bottom of page 5, the specification describes plasma graft polymerization as one example that can be used in the production of the electrolyte membrane, which involves irradiating a substrate with plasma to generate a reaction start point on the surface of the substrate, as well as on the inner surface of the pores of the

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substrate. Then, preferably contacting monomers with the substrate by liquid phase polymerization to graft-polymerize the monomers, both on the surface and in the pores of the substrate. At the top of page 6, the specification describes the plasma treatment step provides the reaction start points on the surfaces of the substrate, including the inner surfaces of the pores. (Page 6, third ¶). The plasma-treated substrate is then subjected to contact with aqueous solution containing monomers. The porous substrate, having the reaction start points formed thereon, may be immersed in the aqueous solution of the monomers. Then, the porous substrate is removed from the aqueous solution after a predetermined time, washed with organic solvents such as toluene or xylene and dried. In this way, by-products produced during the polymerization process, such as homopolymers, can be removed by washing with such organic solvents while the graft polymer may be left on the surface and inner spaces of the pores and the substrate.

Accordingly, the "graft polymer" in Claims 14, 24, 31, 42, and 84 is grafted to the substrate including the surfaces of the pores. This provides the membrane with advantages. A polymer grafted to the porous substrate so that it is chemically bound on the surfaces on the inside of the pores gives the claimed electrolyte membrane its advantages. Namely, 1) methanol crossover is reduced, because the polymer which fills the pores cannot be released from the pores when grafted, and 2) high proton conductivity is exhibited because of the binding of the graft polymer having high proton conductivity to a surface of the pore. Thus, the pore of the substrate becomes a channel of proton conductivity when the pore is filled with the graft polymer.

Bahar et al. does not disclose nor suggest the use of a proton conductive graft polymer, which is grafted to a surface of the pore substrate. Like WO 96/29752 (Grot et al.), Bahar et al. only discloses polymers being applied using the "solution casting method."

Bahar et al. teaches that the ion-exchange resin materials are polymers, not monomers, when applied to the substrate. Accordingly, because neither the polymers nor the substrate has reactive functional groups suitable for grafting, the polymers that fill the pores are not "graft" polymers. Bahar et al. teaches fluorinated or non-fluorinated polystyrene sulfonates and sulfonated polytetrafluoroethylene. They can also be ionic polymers derived from polyvinyl alcohol and styrene-based polymers. (Page 4, lines 33-p. 5, line 3).

Accordingly, because Bahar et al. teaches that the ion-exchange materials have already been polymerized, it is not possible that such materials can form graft polymers with the substrate.

Further evidence that Bahar et al. does not produce a graft polymer and therefore cannot attain the advantages 1) and 2) mentioned above, Bahar et al. describes only solution casting methods of making the membranes.

As described in previous responses filed on October 11, 2006 (page 14 and Declaration) and May 3, 2006, the filler obtained by the "solution cast method," which fills pores of the membrane, will leach out from the pores, when the membrane is immersed in rich solvent (in this case, in methanol).

Bahar et al. similarly describes a solution casting method. For example, on page 22, lines 12-21, Bahar et al. describes a solution of perfluorosulfonic acid/tetrafluoroethylene copolymer resin (Nafion) being brushed on both sides of the membrane so as to impregnate and substantially occlude the micropore structure. Also on page 23, lines 10-15; page 24, lines 30-35; page 24, lines 6-14; page 24, lines 24-28; page 25, lines 7-10; and page 25, lines 25-29, Bahar et al. only describes a Nafion solution being brushed on the membrane.

Accordingly, because Bahar et al. describes the ion-exchange resins are all polymers and that these polymers are applied via a solution casting method to the membranes, Bahar et al. cannot teach nor suggest graft polymers bound to the surfaces of pores.

Furthermore, Claims 14 and 66 recite "a porous substrate that does not swell substantially with organic solvents or water."

Bahar et al. describes that the membrane does swell in water. For example, on page 22, lines 27-29, Bahar et al. describes the membrane was boiled in distilled water for ten minutes under atmospheric pressure to swell the treated membrane. Similarly, on page 23, lines 18-20; page 23, in the sentence bridging pages 23 and 24; and on page 24, lines 16-18, Bahar et al. describes swelling of the membrane.

Accordingly, there is ample evidence that the membrane described by Bahar et al., in fact, does swell with water.

Further still, Claim 66 recites "the porous substrate consists essentially of an inorganic material selected from the group consisting of ceramics and glass."

In contrast, Bahar et al. discloses the use of microporous polymer films, such as polyamides, polycarbonates, celluloses, polyurethanes, polyesters, polyethers, polyacrylates, copolyether amides, chitosan and fluoropolymers, which are all organic. Bahar et al., at most, describes the ion-exchange resin materials may include silica, titanium oxide, etc. It is submitted that the ion exchange resin material is not the same as the porous substrate.

Further, Claim 49 relates to a method for manufacturing a fuel cell. In particular, Claim 49 defines the method comprising the steps of applying a sol to a first electrode.

Bahar et al. does not disclose any method for manufacturing a fuel cell. In particular, Bahar et al. never even mentions the term electrode.

Accordingly, for the foregoing reasons, the withdrawal of the rejection of Claims 14-22, 24-29, 31-36, 42-47, 49-54, 66-70, and 84-88, is respectfully requested.

Allowable Subject Matter

Applicants gratefully acknowledge the indication of allowable subject matter in Claims 23, 30, 37, 38, 48, 55-57, and 71.

CONCLUSION

In view of the foregoing remarks, applicants respectfully submit that the application is in condition for allowance. If there are any further questions or comments, the Examiner is invited to contact the applicants' attorney at the number provided below.

Respectfully submitted,

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